

Parasitology

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Parasitology

Protozoology (Protozoa)

Helminthology (Metazoa)

Sarcomastigophora

Apicomplexa

Microspora

Ciliophora

Platyhelminthes
(Flat worm)

Nemathelminthes
(Round worm)

Cestoidea
(Tape worm)

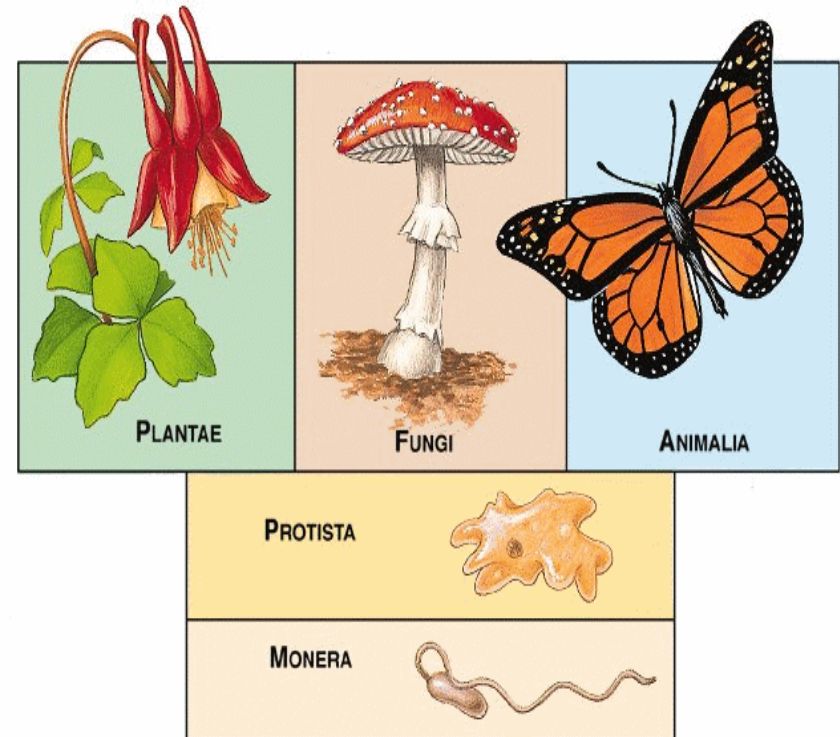
Trematoda
(Flukes)

Nematoda
(Round worm)

Five Kingdom Taxonomic Classification of The World's Biota

(Robert Harding Whittaker, 1969)

1. **Monera** Kingdom: All prokaryotic cells and eubacteria.
2. **Protista** Kingdom: Unicellular eukaryotes, algae and protozoa.
3. **Fungi** Kingdom: Molds and yeasts.
4. **Animalia** Kingdom: Helminthes
5. **Plantae** Kingdom: No known human pathogen.



- **Parasitology:** Branches of science that deals with parasite.
- **Medical Parasitology:** Branch of medical science which deals with the study of parasites of human and their medical consequences.
- **Protozoa:** A subkingdom consisting of unicellular eukaryotic organisms. e.g. Amoeba
- **Metazoa:** A subkingdom of the animal kingdom comprising the multicellular animals. e.g. Helminths

Difference between Protozoa & Metazoa

Protozoa	Metazoa
Unicellular	Multicellular
A single 'cell-like unit'	A number of cells making up a complex individual
A single cell performs all the activities of life	Each cells performs a particular function

- **Parasite:** A living organism which receives nourishment and shelter from another organism where it lives, causing some injurious effect to its host.
- **Host:** Hosts are organism which gives shelter and nourishment to the parasite.
- **Vector:** An insect intermediate host, which introduces the disease causing organism into a susceptible host. The disease causing organism multiplies or develops in the vector prior to becoming infective and introduced into a susceptible individual.

Zoonosis: A disease occurring primarily in wild and domestic animals that can be transmitted to humans under natural conditions. e.g. rabies, HIV, kala-azar etc.

Reservoir: It is the host where the parasites live without causing any manifest symptoms. From reservoir diseases spread to other man or animal.

Carrier: A host that harbors a parasite but exhibits no clinical signs or symptoms.

Important Pathogenic Protozoa

PROTOZOA	ORGAN OF LOCOMOTION	IMPORTANT HUMAN PATHOGENS
1. Amoebozoa (Entamoebas)	Pseudopodia	<i>Entamoeba spp.</i>
2. Euglenozoa & Metamonida (Flagellates)	Flagella	<i>Trypanosom</i> <i>Leishmania</i> <i>Trichomonas</i> <i>Giardia</i>
3. Myxozoa (Sporozoans)	None, exhibit a slight amoeboid movement	<i>Plasmodium spp.</i>
4. Gliophora (Ciliates)	Cilia	<i>Balantidium coli</i>

Types of Parasites

❑ On the basis of site of infection :

- Ecto-parasite: e.g.- Lice (surface of host)
- Endo-parasite: e.g.- Malarial parasites (inside of body)

❑ On the basis of period of infection :

- Temporary parasite: Visits its host for a short period.
- Permanent parasite: Leads a parasitic life throughout the whole period of its life.
- Facultative parasite: Lives a parasitic life when opportunity arises.
- Obligatory parasite: Can not exist without a parasitic life.
- Occasional or Accidental parasite: Attacks an unusual host.
- Wandering parasite: Happens to reach a place where it can not live.

Types of Host

Definitive Host: A living organism which harbors the adult stage or sexual stage of the parasite. In most parasitic life cycle, human act as a definitive host. Example: In case of AL, AD etc.

Intermediate Host: A living organism which harbors harbours the larval stage or asexual stages of the parasite. Example: in *Plasmodium spp.* And *Echinococcus granulosus* life cycle human acts as a intermediate host.

Accidental Host: Accidental hosts are those the parasite is able to complete its life cycle in which the parasite does not normally develop but when occasionally infections occur accidentally, the parasite may be able (permissive) or unable (non-permissive) to complete its life cycle.

Types of Host

Permissive Host: Permissive hosts are those hosts where the parasite can complete its life cycle.

Non-permissive Host: Non-permissive are those hosts where the parasite, cannot complete its life cycle and eventually die within the host.

Paratenic Host: Also called carrier or transport host- a host where parasites remain viable without further development.

Reservoir Host: Reservoir host is a vertebrate animal species that harbors a particular pathogen and acts as a long-term source of infection for other vertebrates or vectors. Example: in Indian kala-azar human is the reservoir host for *Leishmania donovani*.

Types of Host-Parasite Relationship

- **Symbiosis:** Both partners are mutually benefited. None can live without the help of other.
- **Commensalism:** Organism receives benefit without causing harm to the host.
- **Parasitism :** Organism derives benefit, causing injury to the host. Host in turn offers some resistance to the parasite. A parasite loses its power to lead independent life.

Effect of Parasites on the Host

The damage which pathogenic parasites produce in the tissues of the host may be described in the following two ways;

❑ Direct effects of the parasite on the host

- Mechanical injury - may be inflicted by a parasite by means of pressure as it grows larger, e.g. Hydatid cyst causes blockage of ducts such as blood vessels producing infraction.
- Deleterious effect of toxic substances- in *Plasmodium falciparum* production of toxic substances may cause rigors and other symptoms.
- Deprivation of nutrients, fluids and metabolites - parasite may produce disease by competing with the host for nutrients.

Effect of Parasites on the Host

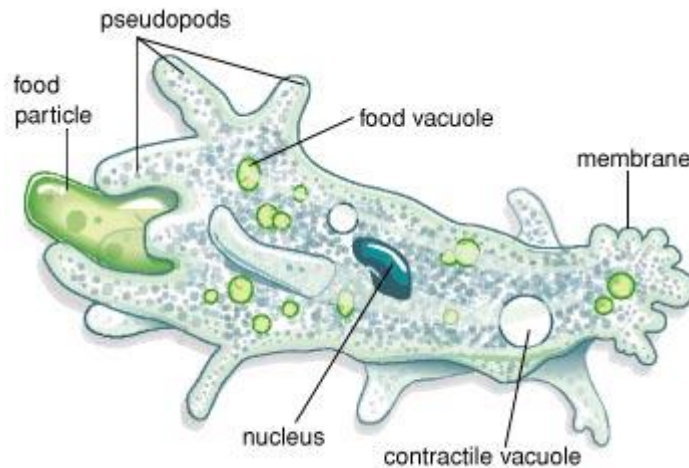
❑ Indirect effects of the parasite on the host:

Immunological reaction: Tissue damage may be caused by immunological response of the host, e.g. nephritic syndrome following Plasmodium infections.

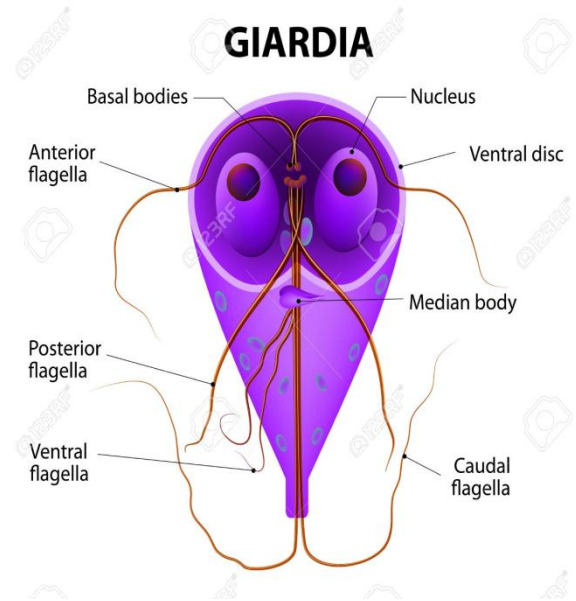
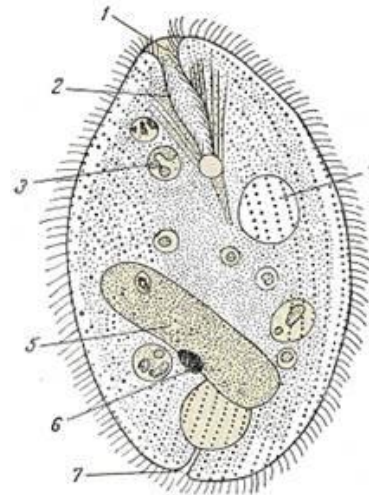
Excessive proliferation of certain tissues due to invasion by some parasites can also cause tissue damage in man, e.g. fibrosis of liver after deposition of the ova of *Schistosoma*.

Organelle of Locomotion

- Pseudopodia in Rhizopoda
- Flagella in Mastigophora
- Cilia in Ciliata



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Mode of Infection

- **Route by which organisms enter into the host**
 - **Oral route:** eating food and drinks contaminated with cysts and eggs.
 - **Penetration** through skin and mucous membrane; eg. Filariform larva
 - **By vectors**, e.g. malaria, kala-azar etc.

Transmission of Parasites

- Oral
- Faecal-oral
- Direct Contact
- Vector Borne
- Skin Penetration
- Blood Borne
- Transplacental
- Sexual: Normal & Abnormal
- Others: Through Nasal Mucosa

Transmission of Protozoa

In most parasitic protozoa, the developmental stages are often transmitted from one host to another within a cyst. The reproduction process is also related to the formation of the cyst. Asexual reproduction of some ciliates and flagellates is associated with cyst formation, and sexual reproduction of Sporozoa invariably results in a cyst. Pathogenic protozoa can spread from one infected person to another by:

- Faecal–oral transmission of contaminated foods and water.
- Insect bite inoculums or rubbing infected insect faeces on the site of bite.
- Sexual intercourse

Reproduction

The methods of reproduction or multiplication among the parasitic protozoa are of the following types:

1. Asexual Multiplication:

(a) Simple binary fission – in this process, after division of all the structures, the individual parasite divides either longitudinally or transversely into two more or less equal parts.

(b) Multiple fission or schizogony – in this process more than two individuals are produced, e.g. asexual reproduction in Plasmodia.

2. Sexual Reproduction:

(a) Conjugation – in this process, a temporary union of two individuals occurs during which time interchange of nuclear material takes place. Later on, the two individuals separate.

(b) Syngamy – in this process, sexually differentiated cells, called gametes, unite permanently and a complete fusion of the nuclear material takes place.

The resulting product is then known as a zygote.

Laboratory Diagnosis

- **Direct Evidence:** demonstration of parasite by examination of specimen such as,
 - Blood, stool, urine, sputum, bone marrow, biopsy material etc.
- **Indirect Evidence:**
 - Routine Blood Examination
 - Serological Test
 - Intradermal (ID) Test

Treatment

Many parasitic infections can be cured by specific chemotherapy. The greatest advances have been made in the treatment of protozoal diseases.

For the treatment of intestinal helminthiasis, drugs are given orally for direct action on the helminthes. To obtain maximum parasitocidal effect, it is desirable that the drugs administered should not be absorbed and the drugs should also have minimum toxic effect on the host.

Prevention & Control

Preventive measures designed to break the transmission cycle are crucial to successful parasitic eradication. Such measures include:

- **Reduction of the source of infection- the parasite is attacked within the host, thereby preventing the dissemination of the infecting agent. Therefore, a prompt diagnosis and treatment of parasitic diseases is an important component in the prevention of dissemination.**
- **Sanitary control of drinking water and food.**
- **Proper waste disposal.**
- **The use of insecticides and other chemicals used to control the vector population.**
- **Protective clothing that would prevent vectors from resting in the surface of the body and inoculate pathogens during their blood meal.**
- **Good personal hygiene.**
- **Avoidance of unprotected sexual practices.**

Recommended Books

1. Parasitology by K.D. Chatterjee
2. District Laboratory Practices for Tropical Countries by Monica Cheesbrough
3. Practical Pathology & Microbiology by K.A. Khaleque

